Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of	)	
	)	
Amendment of the Commission's Rules with Regard to Commercial Operations in the 3550-3650 MHz Band	)	GN Docket No. 12-354

COMMENTS OF NOKIA SIEMENS NETWORKS US LLC

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Nokia Siemens Networks US LLC ("Nokia Siemens Networks") hereby responds to the Commission's Notice of Proposed Rulemaking ("NPRM")[1] seeking comment on commercial use of the 3550-3650 MHz spectrum band ("3.5 GHz Band"). Nokia Siemens Networks views the 3.5 GHz Band in the United States as a complementary yet important swath of spectrum with significant potential to supplement efforts to expand the capacity and reach of current and future mobile broadband networks in order to meet constantly escalating demand. In the comments that follow, Nokia Siemens Networks offers its initial views on how the unique set of challenges this band presents in terms of licensing and its availability for commercial use might be overcome. Specifically, to the extent that exclusive licensing is not utilized, Nokia Siemens Networks recommends that the Commission strongly consider employing a licensed sharing model, specifically Authorized Shared Access, for its potential to assist with meeting the market's current and future mobile broadband capacity requirements.

[1] *Amendment of the Commission's Rules with Regard to Commercial Operations in the 3550-3650 MHz Band*, GN Docket No. 12-354, Notice of Proposed Rulemaking, FCC 12-148 (rel. Dec. 12, 2012) ("NPRM").

I. INTRODUCTION.

Nokia Siemens Networks is the world's specialist in mobile broadband. Innovating at the forefront of each generation of mobile technology, Nokia Siemens Networks provides the world's most efficient mobile networks, the intelligence to maximize the performance of these networks, and the services to make it all work seamlessly. Nokia Siemens Networks is leading the commercialization of Long Term Evolution (LTE), both FDD LTE and TD-LTE, in terms of commercial references[2] and live network performance. This includes pioneering efforts in reducing the footprint of mobile base station infrastructure, from compact yet full power macro sites down to the full range of "small cell" solutions. Nokia Siemens Networks also offers the industry's most comprehensive portfolio of services for integrating heterogeneous networks ("HetNets"), encompassing analysis, optimization, deployment and management.

In its recent comments to the Commission in the broadcast spectrum incentive auction proceeding, Nokia Siemens Networks again highlighted the rocketing demand for mobile broadband connectivity and the corresponding need for additional spectrum.[3] The Commission continues to consistently acknowledge it as well. The reality is that a reasonable debate about the issue no longer exists.

The mobile broadband industry continues to prioritize cleared, exclusively licensed spectrum suitable for mobile networks, with low band spectrum particularly ideal for wide area coverage. Unquestionably this must remain the absolute top objective if the United States is to maintain a leading position in advanced mobile networks and succeed in connecting and upgrading all of its citizens with the necessary digital tools of the 21st century. Nokia Siemens

[2] As of February 11, 2013, Nokia Siemens Networks had 78 commercial LTE agreements in place. Out of these, at least 26 operators have already commercially launched LTE and serve about 40% of all LTE subscribers worldwide.
[3] *See* Comments of Nokia Siemens Networks US LLC, GN Docket No. 12-268, at 4-6 (filed Jan. 25, 2012).

Networks also believes that the 3.5 GHz spectrum at issue in this proceeding holds the potential to supplement these networks for capacity improvements in particular. As the Commission has identified, there are challenges to utilization of the band that must be overcome such that exclusive licensing may not be possible, at least not in an entirety of the spectrum and in all geographic locations. While Nokia Siemens Networks still encourages the Commission to explore exclusive licensing, we offer in these comments some considerations on how the identified challenges might be addressed.

II. UTILIZATION OF THE 3550-3650 MHZ BAND.

Nokia Siemens Networks has spent considerable efforts researching possible uses of the spectrum being examined in this proceeding. As the Commission rightfully observes, available spectrum is very limited so all scenarios should be examined and explored.

Nokia Siemens Networks expects to see small cell deployments proliferate widely. Key to the realization of this scenario, however, is the availability of spectrum. While reuse of existing bands supporting wide area commercial mobile radio services (CMRS) is part of the equation, it is unlikely to be sufficient. Nokia Siemens Networks agrees with the Commission that the combination of the propagation characteristics of the 3.5 GHz band and the inevitable limitations on its use due to incumbent users make small cell use of the band a potentially attractive proposition. This does not mean, however, that the Commission must enact such a preference into its regulations. For example, there may be interest in deploying higher powered systems in areas away from incumbent users. A hallmark of good spectrum policy in recent years is allowing for flexible use and maintaining technology neutrality and that should apply here as well.

In terms of potential users of the spectrum, Nokia Siemens Networks is concerned that the Commission may be giving short shrift to the potential use of this spectrum by wireless network operators seeking to add much needed capacity and enhance coverage for their mobile broadband networks. While the Commission observes that the mobile operator community has not prioritized access to this band in comparison with lower spectrum bands better suited for wide area coverage, Nokia Siemens Networks nonetheless believes that this band can play a significant role in the mobile network architecture. We encourage the Commission to guard against making decisions in this proceeding that needlessly foreclose the possible development of a viable market for such solutions. A prime example would be defining eligibility for any potential priority access class too narrowly.

III. THE IMPORTANT BENEFITS OF GLOBALLY HARMONIZED SPECTRUM SHOULD NOT BE OVERLOOKED.

The amount of spectrum required to support mobile broadband services is expanding exponentially. Correspondingly increasing is the desirability for the existing and newly identified spectrum to be harmonized globally across frequency range, channel plans, and emissions requirements. Spectrum harmonization helps to achieve economies of scale, enables global roaming, reduces equipment design complexity and improves spectrum efficiency.[4] All of this ultimately reduces costs for consumers. In particular, device costs are a significant issue as widely supported spectrum bands and channels can lower the crucial radio frequency (RF) component costs. Harmonization also aids in addressing cross border coordination.

[4] *See* Document 5D/246-E, Canada's input to ITU-R WP 5D, "Technical perspective on benefits of spectrum harmonization for mobile services and IMT," 23 January 2013.

A. Time Division Duplex (TDD) Mode in the 3.5 GHz Band.

Harmonization in terms of a band plan includes the duplex mode of operation that may be deployed. Harmonizing the duplex mode with global preferences brings the economy of scale benefits highlighted above. Moreover, spectral efficiencies and other considerations factor into a decision on what band plan to apply.

For the 3400-3800 MHz spectrum range, 3GPP has defined two spectrum bands based on Time Division Duplex (TDD) mode and one band based on Frequency Division Duplex (FDD) mode.[5]

- TDD Band 42: 3400-3600 MHz
- TDD Band 43: 3600-3800 MHz
- FDD Band 22: 3410-3490 MHz uplink/3510-3590 MHz downlink

3GPP defined these three bands based on a survey of how spectrum is allocated in various countries worldwide.

Spectrum below 3600 MHz and above 3600 MHz is allocated independently of each other. For instance, the European regulator CEPT[6] considered the band 3.4-3.8 GHz as two separate bands.[7]

- A lower band: 3.4-3.6 GHz
- An upper band: 3.6-3.8 GHz

[5] *See* 3GPP TR 3GPP TR 37.801 V10.0.0 (2011-10), "Technical Specification Group Radio Access Networks; UMTS-LTE 3500 MHz Work Item Technical Report (Release 10)."
[6] European Conference of Postal and Telecommunications Administrations.
[7] *See* CEPT ECC PT1 #42, Marseille, 09 January 2013, Bolloré Telecom, Huawei, Linkem, Nokia, NSN, UK Broadband, "Preferred band plan for 3.4-3.6 GHz."

In Japan, not only 3.4-3.6 GHz but also 3.6-4.2 GHz will be available to terrestrial mobile service such as International Mobile Telecommunications ("IMT"). Discussions have started to define the band plan for 3.4-3.6 GHz, again separating the 3.4-3.6 GHz from spectrum above 3.6 GHz.

As a result, currently there is no single 3GPP band that covers the entire 3550-3650 MHz range.

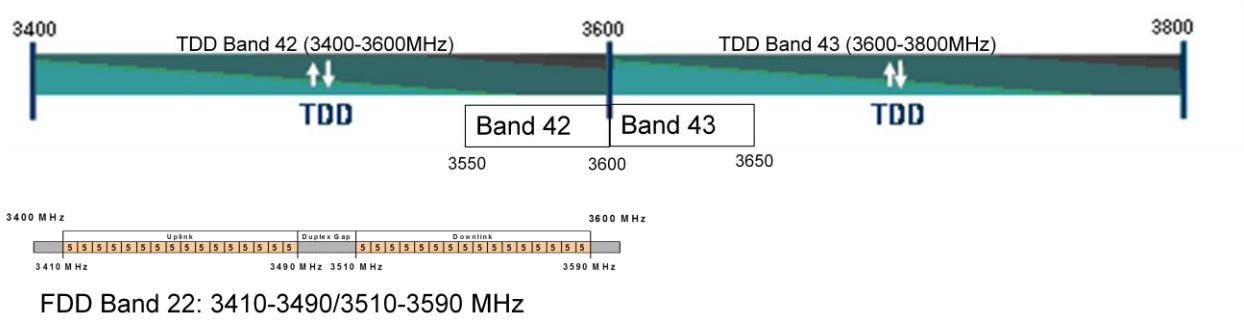

Figure 1: 3GPP Bands covering 3.4-3.8GHz

The 3550-3650 MHz spectrum range thus overlaps the two existing 3GPP TDD bands.

- 50 MHz in 3550-3600 MHz: band 42
- 50 MHz in 3600-3650 MHz: band 43

The 3550-3650 MHz band could be segmented at a high level into two blocks of 50 MHz each that would be covered by the existing TDD Band 42 and Band 43. If the Commission decides that this full spectrum range is to be used as a single block for TDD, then a new TDD band will need to be defined in 3GPP. If FDD is used in the spectrum, then a new FDD band would need to be defined in 3GPP. Defining a new band in 3GPP typically takes one year or

more after the Work Item is approved in 3GPP, which is normally done after the regulators have defined the band plan. Any new band that is unique to the U.S. could delay availability of devices and infrastructure and would not reap the benefits discussed above from a global harmonization point of view. In that respect, the two TDD bands 42 and 43 would enable harmonization with the rest of the world.

TDD mode efficiently uses the spectrum by inherently allowing configurable asymmetry.[8] This may be partly restricted if synchronization, *e.g.* via global positioning system (GPS) and/or alignment of Downlink/Uplink (DL/UL) transmissions, is implemented in different cells of the same network or in a multi-operator context to eliminate the base station-to-base station and terminal-to-terminal interference. However, the resulting common DL/UL ratio is still well suited to the needs and can always be changed to reflect the existing DL/UL ratio in mobile traffic. In a context where the effective DL/UL ratio may be up to 8:1, TDD allows the spectral resource to be used efficiently. Moreover, as a significant volume of mobile traffic occurs in "hot spots" and indoor environments, heterogeneous networks ("HetNets") consisting of high power/wide area and low power/local area network nodes are emerging. Such HetNets would allow for dynamic UL/DL configuration in TDD systems, tailored to the traffic needs of a specific cell area while mitigating interference between the various cells.[9]

The TDD option would also allow expansion of the band downwards from 3550 MHz and upwards from 3650 MHz in the event additional spectrum is made available while still being covered by 3GPP Bands 42 and 43. An FDD band would not allow as smooth expansion since

[8] *See* Zukang Shen, Chinese Academy of Telecommunication Technology; Alexey Khoryaev, Intel Corporation; Erik Eriksson, Ericsson; Xueming Pan, Chinese Academy of Telecommunication Technology; "Dynamic Uplink-Downlink Configuration and Interference Management in TD-LTE," IEEE Communications Magazine (November 2012).

[9] *Id.*

the duplex distance of any added spectrum would be different from the duplex distance the Commission would define for 3550-3650 MHz.

In any case, Nokia Siemens Networks does not recommend mixing FDD and TDD in the same band because of the guard bands needed at each FDD/TDD frequency border which would make for inefficient use of the spectrum. Potentially, filters to improve the out-of-band emissions and receiver blocking would also be needed to enable FDD/TDD coexistence along with site engineering measures. In the context of small cells where size, weight and cost are particularly critical, allowing a mix of FDD and TDD could become a very limiting factor to the ubiquitous deployment of small cells in 3.5 GHz.

B. Comparing 3GPP TDD Bands 42 and 43 with FDD Band 22.

Looking at the existing 3GPP 3.5 GHz TDD and FDD bands may help project how the market may generally lean in terms of utilization of 3.5 GHz spectrum. [10]

- **Terminals for small cells**: In general, it is expected that 3.5 GHz will not be used for ubiquitous mobile coverage, but rather as a capacity layer, mostly in urban areas. Because of this, the incremental cost for adding this band into multi-mode, multi-band terminals must be reasonable. Additional cost is incurred by having multiple antennas in order to provide large data rates to the dense areas. FDD Band 22 has a 2x80 MHz arrangement. While covering 2x80 MHz using a single duplexer may be feasible in the future, it is reasonable to implement this band arrangement using a split duplexer solution in the initial deployment. One possible implementation is to cover the 80 MHz passband with two 50 MHz filters with

[10] *See* CEPT ECC PT1 #42, Marseille, 09 January 2013, Bolloré Telecom, Huawei, Linkem, Nokia, NSN, UK Broadband, "Preferred band plan for 3.4-3.6 GHz."

a 20 MHz overlap as shown in Figure 2 below.[11] However, the two filter approach to implement 3GPP FDD Band 22 would add cost and might deter the implementation of FDD Band 22 while favoring the implementation of TDD Bands 42 and 43.

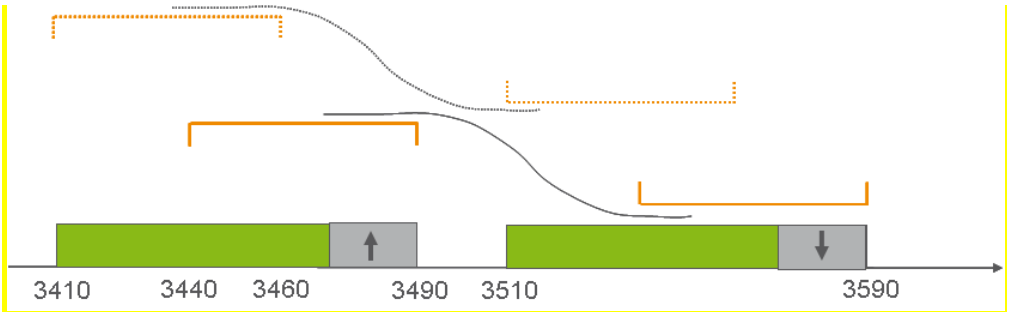

Figure 2: Split duplexer arrangement for UE with a 20 MHz overlap in 3GPP Band 22 (TR 37.801)

- **Sensitivity**: The following table excerpted from 3GPP Technical Specification 36.101[12] compares the reference sensitivity for both FDD Band 22 and TDD Band 42 options and shows that FDD Band 22 has sensitivity 2 dB worse than TDD Band 42. Compared to FDD Band 22, the higher sensitivity of TDD Band 42 helps better overcome the larger path loss and wall penetration loss at 3.5 GHz compared to lower bands. This could better position TDD Bands 42 and 43 as the preferred bands compared to FDD Band 22 when it comes to the deployment of small cells in 3.5GHz.

Table 1: Reference sensitivity QPSK PREFSENS (TS 36.101)[13]

Channel bandwidth							
E-UTRA Band	**1.4 MHz (dBm)**	**3 MHz (dBm)**	**5 MHz (dBm)**	**10 MHz (dBm)**	**15 MHz (dBm)**	**20 MHz (dBm)**	**Duplex Mode**
22			-97	-94	-92.2	-91	FDD
42			-99	-96	-94.2	-93	TDD

[11] *See* 3GPP TR 3GPP TR 37.801 V10.0.0 (2011-10), "Technical Specification Group Radio Access Networks; UMTS-LTE 3500 MHz Work Item Technical Report (Release 10)."
[12] 3GPP TS 36.101 version 10.6.0 Release 10 (2012-03).
[13] *Id.*, Table 7.3.1-1: Reference sensitivity QPSK PREFSENS, 3GPP TS 36.101 version 10.6.0 Release 10 (2012-03).

- **Roadmap**: Single-band TD-LTE chipsets and devices are already available, and multi-mode/multi-band devices are expected in 2013. To our knowledge, there is no LTE FDD product or chipset available, and no visibility in terms of a commercial roadmap.
- **Transition and/or coexistence with existing systems:** The 3.5 GHz Band is used by WiMAX TDD systems in many regions worldwide. It is technically possible to synchronize and align the DL/UL transmissions of WiMAX and TD-LTE to enable coexistence of the two systems either during a transition phase when an operator is migrating from WiMAX to TD-LTE or when a WiMAX operator has to coexist with a TD-LTE operator in adjacent spectrum blocks. On the other hand, the migration from WiMAX TDD to an FDD technology could require guard bands, filters on base stations and site engineering measures and is less attractive. Therefore, it is likely that in many regions worldwide, migration to TD-LTE will be the preferred option helping to drive the ecosystem towards a TD-LTE solution.

Based on the above technical and commercial considerations, Nokia Siemens Networks suggests that a TDD arrangement for this band would closely align with worldwide harmonized band plans and therefore help achieve economies of scale, foster deployment and drive commercial adoption.

IV. AN ALTERNATIVE SPECTRUM ACCESS APPROACH UTILIZING AUTHORIZED SHARED ACCESS COULD SPUR DEPLOYMENT.

The commercial mobile market has blossomed under a framework of access to exclusively licensed spectrum. This paradigm is driving the deployment of robust 4G broadband networks across the country. That will continue to be the case, and Nokia Siemens Networks

agrees with a consensus industry view that this is the model that needs to continue to predominate. Moreover, identifying additional spectrum for exclusive licensing must remain the top objective for government spectrum decision makers. In particular, efforts to identify and clear spectrum that is used today by the federal government need to continue and suggestions that sharing paradigms are now the norm should be rejected.[14]

As a result, Nokia Siemens Networks believes that the possibility of exclusively licensing some or all of 3550-3650 MHz should not be summarily dismissed. The Commission lays out the unique challenges the band presents that could result in a detour from the predictable path of exclusive licensing. In particular, incumbent users of portions of the spectrum are expected to remain in place for years to come. As a result, the Commission has set out in pursuit of a framework to maximize new commercial use of this band while protecting legacy systems. However, as the bands clearly are not utilized everywhere, it certainly would seem that some level of geographic licensing would be possible and should be explored.

The main licensing proposal in the *NPRM* reflects recommendations made in a 2012 report by the President's Council of Advisors on Science and Technology (PCAST).[15] The PCAST Report advocates a new spectrum usage model that allows commercial users to share spectrum with government users and with each other. The PCAST Report recommends that shared access to Federal spectrum should be governed according to a three-tier hierarchy:

[14] Last year's oft-called "Spectrum Act" included provisions establishing deadlines for the clearing and auctioning of spectrum bands and prioritizing the relocation of government users over sharing. *See* Middle Class Tax Relief and Job Creation Act of 2012, Pub. L. No. 112-96, §§ 6401, 6701, 126 Stat. 156 (2012).

[15] PCAST, Report to the President: Realizing the Full Potential of Government-Held Spectrum to Spur Economic Growth (rel. July 20, 2012) (PCAST Report), *available at* http://www.whitehouse.gov/sites/default/files/microsites/ostp/pcast_spectrum_report_final_july_20_2012.pdf.

- Federal primary systems would receive the highest priority and protection from harmful interference;
- Secondary licensees must register deployments and use in a database and may receive some quality of service protections, possibly in exchange for fees;
- General Authorized Access users would be allowed opportunistic access to unoccupied spectrum to the extent that no Federal Primary or Secondary Access users are actually using the spectrum in a specific geographical area or time period.

It should be noted that the PCAST report does not exclude non-critical users that require some guarantee of Quality of Service ("QoS") from inclusion in the Secondary Access tier. This is one major difference with the following Commission proposal that is based on the PCAST report:[16]

- Incumbent Access that would include authorized federal users and grandfathered fixed satellite service (FSS) licensees. These incumbents would be afforded protection from all other users in the 3.5 GHz Band.
- Priority Access that would include critical use facilities, such as hospitals, utilities, government facilities, and public safety entities that would be afforded quality- assured access to a portion of the 3.5 GHz Band in certain designated locations.
- General Authorized Access (GAA) that would include all other users – including the general public – that would have the ability to operate in the 3.5 GHz Band subject to protections for Incumbent Access and Protected Access users and can use the spectrum when Incumbent and Priority Access users are not using it.

[16] *See NPRM*, ¶¶53-76.

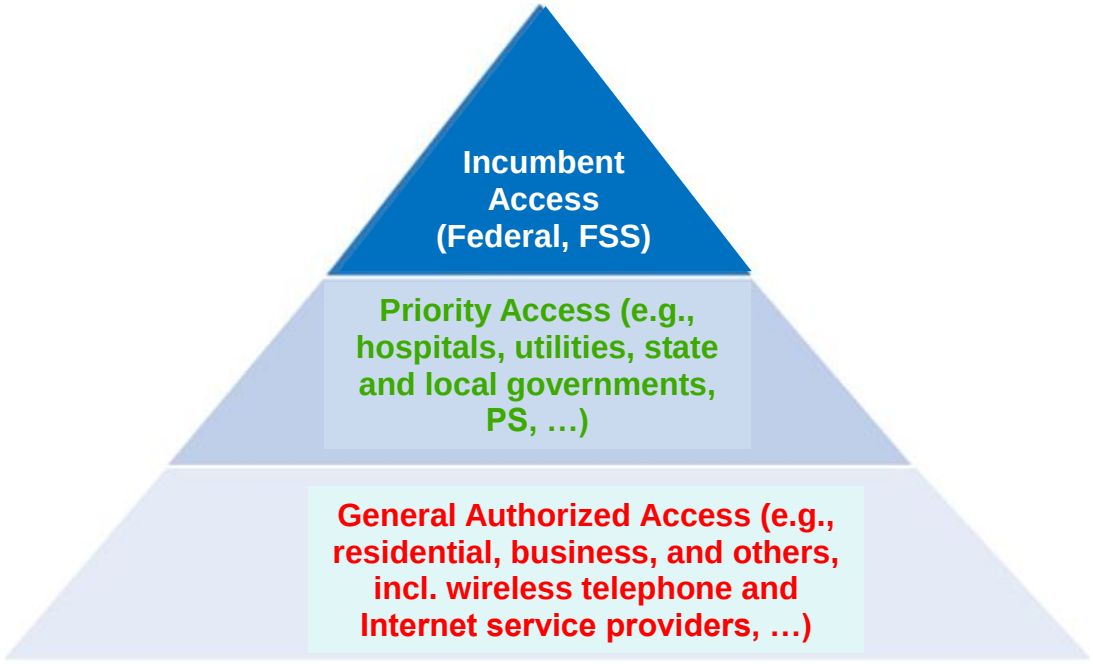

Figure 4: FCC's Three-Tier Model largely reflecting the PCAST Report

The Commission also asked for comment on the promising Authorized Shared Access (ASA) concept being explored currently in Europe[17] based on a proposal from Nokia and Qualcomm.[18] Nokia Siemens Networks believes that an ASA model as outlined below would appear to be the best solution for enabling deployment in the 3550-3650 MHz band (if it is not possible to make the band exclusively available for mobile broadband). ASA offers a better defined environment for deployment compared to the Commission's three-tier approach which adds complexity that could impede the rollout of services using the spectrum. The ASA model would result in a two-tier approach as shown in Figure 5.

[17] In Europe, the naming convention Licensed Shared Access (LSA) also is utilized. For purposes of these comments, we do not distinguish between the two and use only ASA throughout for consistency.
[18] *See NPRM*, ¶*84;* Presentation by Qualcomm and Nokia at the WG FM, "Authorized Shared Access, An evolutionary spectrum authorisation scheme for sustainable economic growth and consumer benefit,"17 May 2011.

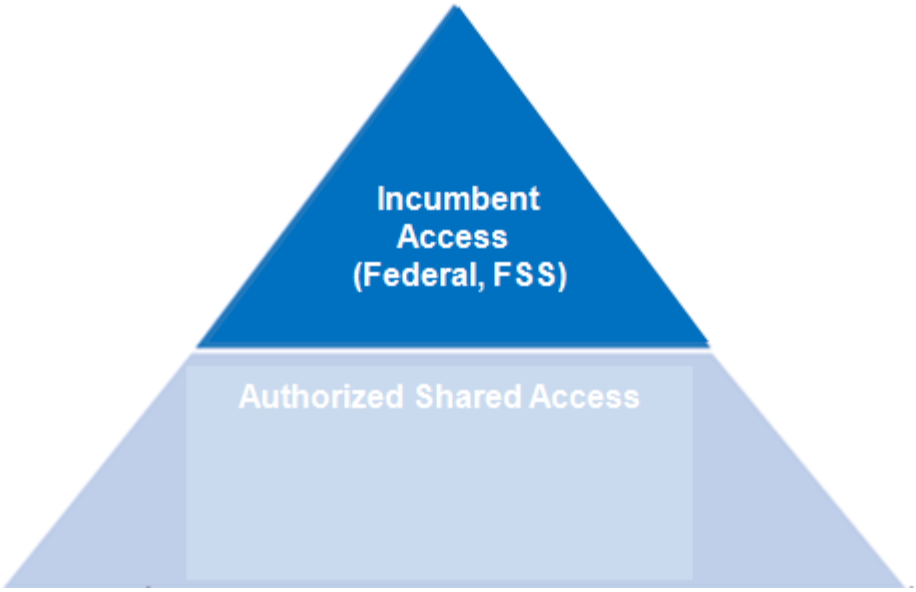

Figure 5: ASA model

This ASA concept is gaining a lot of traction in Europe. The Radio Spectrum Policy Group (RSPG) of the European Union (EU)[19] concluded in its report on spectrum sharing[20] that the current EU Regulatory Framework for Electronic Communications enables implementation of ASA. In November 2012, the Commission asked the RSPG to develop an Opinion on ASA to develop further the requirement of ASA implementation at European and national levels. The Opinion is expected to be ready for public consultation in June 2013 and adopted in November 2013. In particular, EU regulatory guidelines and technical harmonization work within CEPT will be of key importance.

ASA essentially is a third and complementary way of authorizing spectrum, in addition to licensed (exclusive) and license-exempt (unlicensed). The reality is that some spectrum bands

[19] The Radio Spectrum Policy Group (RSPG) is a high-level advisory group that assists the European Commission in the development of radio spectrum policy.

[20] RSPG11-392, Nov. 2011.

below 6 GHz are not in extensive use and could be made available for other usages - either in time, location/geography and/or frequency domains. In many cases, spectrum below 6 GHz is not used across an entire nation or license area at all times—the spectrum is unused in various locations and/or at various times. ASA allows this spectrum, in its entirety, to be used efficiently at all times on a nationwide or license-wide basis.

ASA spectrum rights are granted to ASA licensees subject to the terms defined by the relevant authority (government, regulator) and to the existing usage of the incumbent users. ASA licensees use the spectrum on a shared and non-interference basis with the incumbents. Sharing under the ASA framework is binary by nature, as it permits spectrum use by either the incumbent or the ASA licensee. The ASA licensee enjoys exclusive spectrum rights of use where and when the spectrum is not used by the incumbent. When the incumbent needs the spectrum back, the ASA licensee will need to evacuate the spectrum and likely will shift to other spectrum. There may be one or several such ASA licensees in any given band since ASA rights for a band may be awarded in more than one geographic region, depending on the usage of the incumbent. A key feature of ASA is that it allows offering a predictable quality of service for all spectrum users when each has exclusive access to that spectrum at a given location and at a given time. ASA rights can be granted on a short or long term basis.

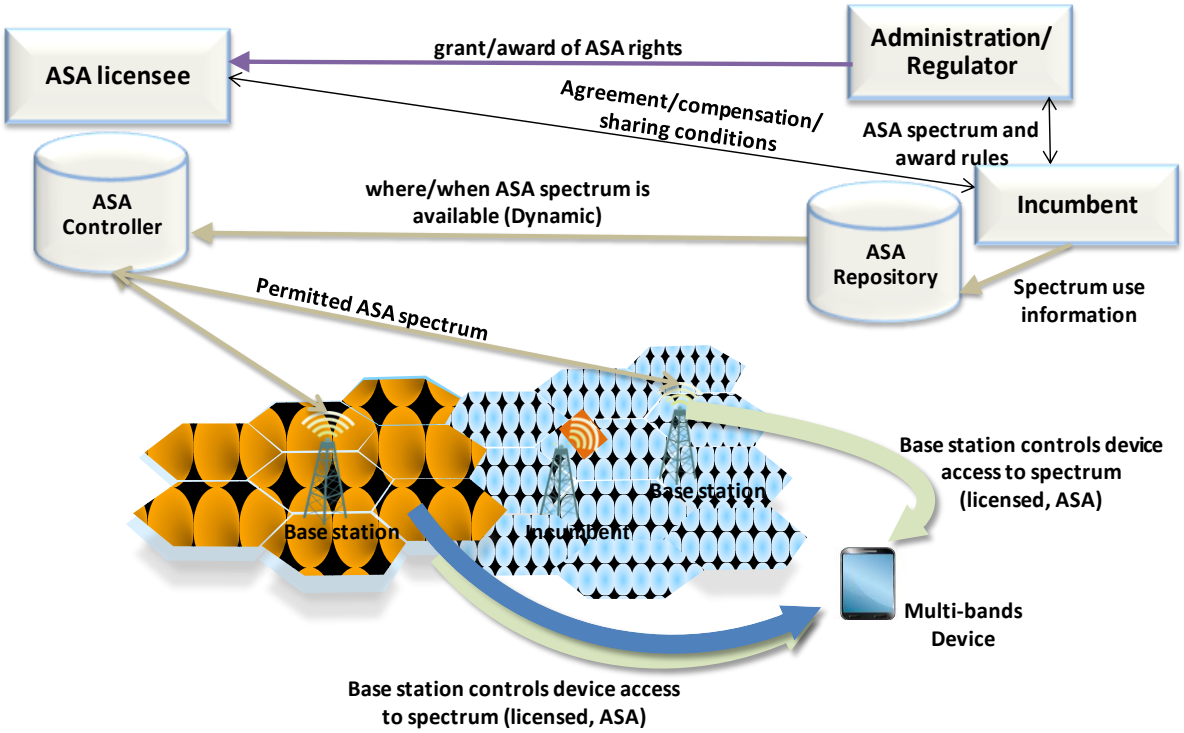

Figure 6: One possible ASA Architecture

The ASA's architecture includes two main components: [21]

- *ASA Repository*: This database contains the relevant information on spectrum use by the incumbent (in the spatial, frequency and time domains). There could be one or more repositories per country. The ASA Repository may be directly managed by the regulator or the incumbent, or be delegated to a trusted third party.
- *ASA Controller*: The ASA Controller computes ASA spectrum availability based on certain rules and information on the incumbent's use provided by the ASA Repository. It connects to the ASA Repository through a secure and reliable interface. There could be one or multiple ASA Controllers per country. The ASA Controller can interface with one

[21] *See* Studio Economico Parcu & Associati, November 12, 2012, "Authorised Shared Access (ASA), An Innovative Model of Pro-competitive Spectrum Management," *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2174518.

or multiple ASA Repositories as well as with one or multiple ASA networks. The ASA Controller may be managed by the regulator, the ASA licensee(s) or a trusted third party.

A. ASA Provides Unique Benefits When Compared with the Proposed General Authorized Access or Unlicensed Spectrum Sharing.

The licensed, unlicensed, and ASA regimes are fully complementary, as all are important tools for regulators to use to maximize the use of spectrum to ensure that a sufficient amount is made available for mobile broadband to keep pace with the exponentially growing consumer demand for mobile broadband services, while also maintaining other important uses. Similarly, the Commission is considering in this proceeding a "licensed by rule" regime for its proposed Citizens Broadband Service with these same objectives in mind. It has also utilized a "lightly licensed" approach for the neighboring 3650-3700 MHz band.

Each of these regimes responds to specific requirements and the specific situation in a given spectrum band. Licensed spectrum allows network deployment with predictable QoS and nationwide availability at all times. Unlicensed spectrum is useful for, among other things, capacity offloading in hot spots and for best efforts services. The Commission's licensed by rule proposal shares some characteristics with unlicensed, in particular for the GAA class of users. This GAA class actually is even closer to the opportunistic access model used in the television white spaces as the Commission explains.

ASA allows network deployment with predictable QoS but generally it does not offer quite the same level of nationwide or license-wide availability as exclusively licensed spectrum. Unlicensed, unlike ASA, can only allow best effort access. This is because each sharing user under an unlicensed regime has equal rights to access the spectrum, provided that the user is in

compliance with the operating conditions in the class license. Since there is no management of the different unlicensed users there can be no guarantee of capacity, QoS, wide area coverage or operating conditions. The operating parameters of the proposed GAA class appear to have similar constraints. Actually in a situation where Priority Access use is combined with heavy spectrum demand and utilization by GAA users, the constraints could be even greater. Again, it becomes more akin to the white spaces model, relying on databases to afford opportunistic access when channels are available for use. ASA on the other hand can provide spectrum resources better suited to broadband services that require predictable quality of service ("QoS"), in other words those services which require the ability to manage access among users in order to guarantee the level of capacity and operating conditions.

B. Application of the ASA Model to the 3.5 GHz Band.

Applying the ASA model to the 3.5 GHz band would result in a two tier approach. Under the ASA model, Incumbent users would continue to be protected from harmful interference and the remaining available spectrum would be licensed under criteria similar to those applicable to the *NPRM's* proposed Priority Access tier. Similar database and technological coordination techniques would apply to this model as well and access would be permitted only within designated geographic areas and/or at designated times. GAA use would not be enabled under this alternate proposal.

Nokia Siemens Networks proposes that a wide class of users should be able to gain as unfettered access as possible to this spectrum. In particular, we believe that this spectrum holds the potential to play an important role in mobile broadband network architectures. Therefore, an application of this alternative proposal would not distinguish between the critical nature of the

users as shown in Figure 7, meaning that there is no Priority Access class of users but instead a common ASA class of users or tier is defined. This model would essentially add non-critical users with QoS requirements, including mobile broadband service providers, to the ASA tier along with the critical users. The full 100 MHz could be made available to all of these users since with equal priority, there is no need to partition the spectrum between the critical and non-critical users. A clear benefit to this model is enabling access to a wide swath of spectrum.

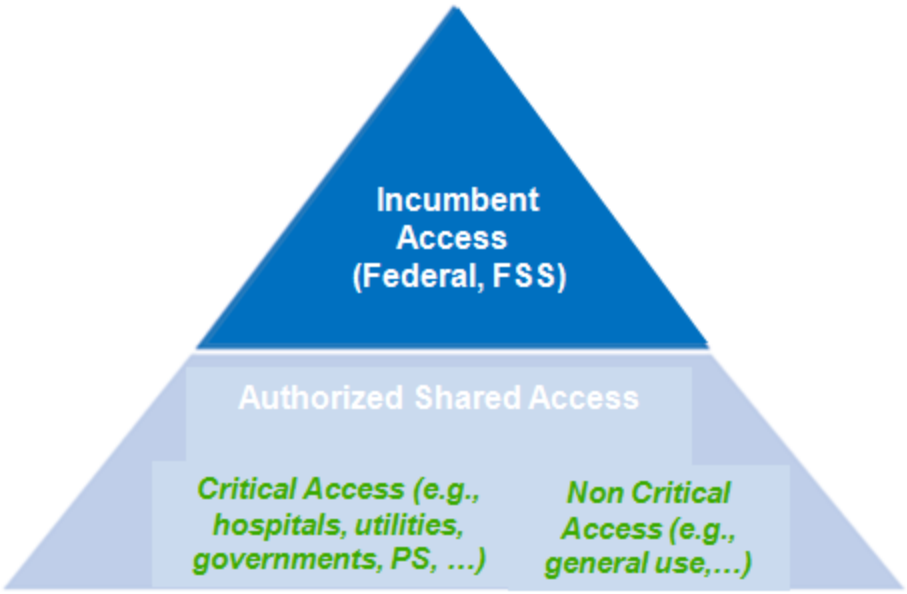

Figure 7: ASA (non critical users added in ASA tier and no distinction between critical and non critical users)

V. REDUCING THE SIZE OF EXCLUSION ZONES MAY BE POSSIBLE.

Nokia Siemens Networks agrees with the Commission that a combination of technical and service characteristics for small cell deployments in the 3.5 GHz Band has the potential to reduce geographic exclusion zones while still providing necessary protections for incumbents.[22] In that respect, the much lower transmit power typically used in small cells as compared to

[22] *NPRM*, ¶109.

macro cells will greatly help mitigate interference from the broadband systems into the incumbent systems.

However, the limiting factor could be interference from incumbent systems into small cells in which case the lower transmit power of small cells cannot help directly. For instance, the current worst case exclusion zone of 450 km derived along the coastline in the NTIA Fast Track Report[23] was indeed based on incumbent systems such as navy radar systems that employ high transmitter power and high gain antennas interfering with commercial broadband technologies in some of the most populated areas of the country.

The 150 km exclusion zone in 3650-3700 MHz around Fixed Satellite Services (FSS) was created based on several assumptions, including that that CMRS licensees would operate high-powered devices which could still be the case with small cells. The Commission allowed licensees in the 3650-3700 MHz band to negotiate with individual FSS earth station licensees for smaller exclusion zones. Allowing similar negotiations in 3550-3650 MHz is also recommended.

Some of the factors to consider when analyzing interference between the incumbent systems and small cells include:

- antenna gain, orientation and height of the access points and devices,
- isolation due to the environment, in particular, any building penetration loss due to indoor deployment of small cells or clutter,
- desense criterion of the small cells receiver to use in the interference analysis,
- propagation models to use,

[23] *See* NTIA, An Assessment of the Near-Term Viability of Accommodating Wireless Broadband Systems in the 1675-1710 MHz, 1755-1780 MHz, 3500-3650 MHz, 4200-4220 MHz, and 4380-4400 MHz Bands (rel. October 2010) (Fast Track Report), *available at* http://www.ntia.doc.gov/files/ntia/publications/fasttrackevaluation_11152010.pdf.

- distance between the small cells and incumbent systems, and
- small cells BS and UE transmit power.

The calculation of an exclusion zone where no other service can transmit based on these parameters can be quite complex and not always a good reflection of reality. Implementation of such exclusion zones, especially when they are large, can also be over-restrictive if the incumbent is not using the spectrum at all times at a given location and therefore an ASA licensee can use that spectrum. The benefit of ASA is that it allows an ASA licensee to utilize the spectrum for mobile broadband on a shared and non-interference basis with the incumbents since the ASA licensee enjoys exclusive spectrum rights of use where and when the spectrum is not used by the incumbent. When the incumbent needs the spectrum back, the ASA licensees can evacuate the spectrum and can migrate to another spectrum block.

VI. CONCLUSION

Nokia Siemens Networks applauds the Commission for moving ahead to explore potential frameworks for making the 3550-3650 MHz band available for commercial use. Nokia Siemens Networks believes that this band holds significant potential to contribute to expanding the capacity of advanced mobile broadband networks. While exclusive use, licensed spectrum continues to be the most appealing prospect for mobile broadband deployment and should be pursued in this case, it is possible that this band could prove to present unique challenges that may require some modifications to that ideal model. In this event, Nokia Siemens Networks implores the Commission to consider licensed sharing models, including Authorized Shared Access, for their potential to assist with meeting the market's current and future mobile

broadband capacity requirements. Nokia Siemens Networks looks forward to continued engagement with the Commission as it moves forward with this important proceeding.

Respectfully submitted,

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